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Troubled water

the UNESCO Courier

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Water is a crucial factor in economic development.

TROUBLED WATER

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On the banks of Asia's longest river, the Yangtze, which winds some 6000 km across China, yaks and yurts cohabit with cars and high-rise buildings. Source of life to six million Chinese, it is undoubtedly also a source of development – as long as the means are there to make use of it. **10**

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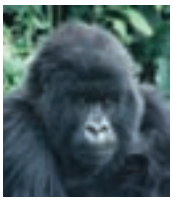

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THE IMPORTANCE OF WATER IN DEVELOPMENT AND ECONOMIC GROWTH

Demand for water has never been greater, due to such factors as population growth, changes in food consumption and increased energy production. These are among the conclusions of the latest *United Nations World Water Development Report,* an assessment of water resources, entitled *'Water in a changing world'*. It highlights the importance of water in development and economic growth.

© Ariane Bailey

Bottom of empty water bottle.

Demand is increasing, and some countries are already reaching the limits of their water resources. The effects of climate change are likely to aggravate this situation even further. Competition for water is intensifying – whether between countries, urban and rural areas, or different sectors of activity. This may make water an increasingly politicized issue.

Access to basic water-related services remains inadequate in much of the developing world. The link between poverty and water resources is obvious: the number of people living on less than US$1.25 a day coincides approximately with the number of those without access to safe drinking water.

This situation has a major impact on health. Almost 80% of diseases in developing countries are associated with water, causing some three million early deaths. For example, 5000 children die every day from diarrhoea, or one every 17 seconds. In all, about one tenth of all illnesses worldwide could be avoided by improving water supply, sanitation, hygiene and management of water resources.

One kilo of meat = 16,000 litres of water

While part of the population still lacks adequate access to water, demand has never been greater. Freshwater withdrawals have tripled over the last 50 years, while the area under irrigation doubled during the same period. This phenomenon is particularly linked to population growth. The world's population, currently estimated at 6.6 billion, is growing by about 80 million people each year. This means demand for freshwater is increasing by 64 billion cubic metres a year.

Population growth implies increased demand for agricultural products, and so increased demand for water. Agriculture is by far the greatest consumer of water, accounting for 70% of all water consumption (compared to 20% for industry and 10% for domestic use).

There have been changes in lifestyles and eating habits in recent years, in particular an increase in the share of meat and dairy products consumed in emerging countries. The production of a kilo of wheat requires 800 to 4000 litres of water, while a kilo of beef, takes 2000 to 16,000 litres.

Water shortage linked to climate change can also be expected. Experts say that by 2030, 47% of world population will be living in areas of high water stress. Water scarcity in some arid and semi-arid regions will have major impacts on migration. From 24 to 700 million people are expected to be

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Cattle in Abidi, Senegal.

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displaced because of a scarcity of water.

Obviously water is one of the key issues the world, and particularly developing countries, has to face. Yet an inadequate percentage of budget allocation by governments and in official aid goes to water. For example, overseas development assistance to the total water sector has been decreasing and remains at only about 5% of total aid flow.

At the same time, corruption in the water sector may add to the overall cost of these investments: typical examples include falsified meter readings, favouritism in public equipment purchases, and nepotism in the allocation of public contracts. Estimates indicate that 30% of budgets can be siphoned off in some countries. These practices are rarely curbed, despite initiatives by some countries, like South Africa.

Managing crisis

Confronted with shortages, some countries have already begun to integrate their strategies for managing water resources with their development plans. Urban wastewater use remains limited for agricultural purposes, except in certain countries: 40% of uses in the Gaza Strip (Palestinian Territories), 15% in Israel and 16% in Egypt.

Desalination of sea water is another process used in arid regions. It is used to obtain drinking water and for industrial use in countries that have reached the limits of their renewable water resources (e.g. Saudi Arabia, Israel, Cyprus).

Australia has also changed its policies, with a range of new measures. Restrictions have been introduced – on watering gardens, washing cars, filling swimming pools, etc – in the country's major cities. In Sydney, a dual water supply was introduced in 2008 – one for drinking water, another for other uses, which draws on recycled water.

This issue of the Courier includes a series of articles illustrating the main points of the latest World Water Development Report, "Water in a changing world".

Agnès Bardon (UNESCO)

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Fog collectors being constructed in La Ventana, Guatemala

THE WATER WE EAT

© Guy Bescond

Traditional irrigation around Mopti, Mali.

The water we drink is less of a problem than the water we eat. Agriculture absorbs 70% of this resource, which is both omnipresent and scarce. Growing plants that are resistant to drought and salt, desalination and storage are among the solutions recommended by experts to deal with water shortages.

The Earth really ought to be called 'Aqua', because more than two-thirds of our planet is covered by water. It's where life evolved, and, even four billion years later, life still needs it.

Paradoxically, though, water is a commodity in short supply – 97.5% is actually salt water, making it unusable for humanity. And most of the fresh water is not obtainable, either, being frozen in glaciers, inaccessibly deep beneath the earth's surface, or in swamps. Only about 0.0075% of total water is accessible fresh water – and even that is very unevenly distributed around the world.

Water shortage is a big problem, particularly in developing countries, since these countries are mainly arid and dependent upon agriculture, which swallows up most of the water used worldwide. According to the United Nations Water Development Report 2009, this is approximately 70%, and could even double by the year 2050.

Asia is the thirstiest of all. Admittedly, the continent – according to the UN Food and Agriculture Organization – holds the second largest stock of fresh water on earth, but this is also the site of 70% of total irrigated agricultural areas world-wide. The four billion Asians, however, consume only about 6% of the water, and industry 10%. A good 84 % is swallowed up by agriculture.

Things are moving swiftly on the Asian continent. It's estimated that about 9 billion people will be living on Earth in 2050, 5 billion of them in Asia. But it's not just the population figures that are rising; the economy is growing and prosperity increasing, bringing with it a change in consumer behaviour. The production of rice – which is extremely water-intensive anyway – will be joined by the increasing demand for meat. Approximately 2.5 million tons of meat were produced in China in 1960. In 2006 the figure was over 80 million. According to the Institute for Water Education, 3000 litres of water are required to produce one kilogramme of rice, 16,000 litres for a kilogramme of beef.

Wanna fill up – or drink?"

Automobile production is booming too. Between 20,000 and 300,000 litres of water are needed to make a car. Bio fuel has become increasingly popular over the last few years. Cars need fuel, too. Ethanol, made from maize or sugar cane, has become a profitable source of income for farmers in Mexico and Brazil, aggravating not only the problem of food, but that of water, too. About 2500 litres of water are required to produce one litre of ethanol. According to World Energy Outlook 2006, biofuel production is increasing at the rate of approximately 7% per year. This may not present so much of a problem in rain-laden

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Brazil, but biofuel could well become one in the China or India of the future.

Just as you can already hear people in Mexico sometimes saying "Wanna fill up – or eat?" you may one day hear people in Asia asking "Wanna fill up – or drink?"

It's agriculture, then, that's the main water-waster. It is estimated that about half the water used is wasted. That translates to 30% of the Earth's total available fresh water. This gives rise to a huge potential saving. There are several ways to go about it. "Irrigation is very inefficient", says Jan Olof Lundqvist from the Stockholm International Water Institute. "And there is quite a big loss of food during production. That is what we call the loss from tree to fork." About half of all food is lost in harvesting, storage and transportation. "All the food produced needed water – and that means: if we lost the food, we also lost the water."

But savings can be made at the beginning of the production chain as well. Surface irrigation is mainly used in developing countries, usually by damming methods, also used for the cultivation of rice. It is cheap and technically simple. The drawback is that a large proportion of the water is lost by seepage and evaporation – approximately half of it.

It would be easy to make savings here by using drip irrigation. By means of hoses or pipes laid above (or better, below) the ground, small amounts of water are directly aimed at the plants. This method is economical, but also costly. In addition, technical know-how is necessary for laying the pipes and, once installed, cultivation is no longer flexible.

"And it needs very much energy", says Lundqvist. "You need pumps to get the water everywhere. The investments are fairly high – so it is not suitable for every crop, especially not for rice production. It's simply too expensive."

New strategies

Lundqvist can see other avenues for improvement: "For rice production and not so high-value crops you could improve the situation simply by working on the coordination between water supply schedules and farming operations." The problem is simple: there's usually not enough water there when it's needed, and vice-versa. In Lundqvist's opinion there is an urgent need for farmers to improve their water management.

And one final point: "There is a need to utilize more 'green water' in agriculture – which means rainfall", Lundqvist says. "It should be captured and stored, probably by underground storage systems."

But what should be done in areas where it rarely rains? "There, it would be a good thing to have drip irrigation – however, it wouldn't make any sense to grow water-intensive crops there." One solution for these regions – albeit controversial – might be genetically modified plants resistant to drought and salt. "But still: farmers won't use them if they can't sell them", says Lundqvist.

One possible alternative here could be the production of biofuel. *Jatropha curcas* is a spurge plant, the seeds of which contain 30% oil. The plant requires little water, and the oil can be processed to make bio diesel. It does, however,

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© Lisa Grimaud

About half the water used in agriculture is wasted.

© Eko Sulisyono

The *Jathropha curcas* represents a green alternative for biofuel production, needing little water.

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contain toxicants as well. "In India and parts of Africa, *Jatropha* can be grown without competition with water and food production", says Lundqvist. "But it depends on the scale. And I suppose the scale will be fairly modest, compared to the amount of energy that will be needed."

Apart from saving water, the exploitation of new water sources could be the solution, particularly for the other regions. The huge amounts of water in the oceans, for example. But the desalination of water requires lots of energy and money. Which is why, in numerical terms, it doesn't play a big role yet. Only one% of desalinated water is used for agriculture. "Thanks to modern membrane technology, the prices for water desalination have come down," says Lundqvist. "Fifty cents (in US$) per thousand litres – but that's still too expensive for the amounts of water that you need for food production." This is why Lundqvist regards desalination more as an option for producing drinking water and possibly for the production of premium foodstuffs.

If one were to succeed in further reducing the cost of desalination, the water problem could be largely resolved . The Desertec consortium has concepts for linking concentrating solar thermal power (CSP) plants – mirrors that concentrate sunlight and produce cheap electricity on the coast of North Africa and the Middle East - with desalination plants. These regions are the most arid in the world, so their problems could thereby be solved in one fell swoop.

Climate change will also aggravate the water crisis in the future. "It will bring big changes in the rainfall pattern", says Lundqvist. "Therefore it is important to have a strategy to combine irrigation and supplementary irrigation systems with local rainfall better and to store it under the soil." This is a big challenge, but he believes it can be done. "I'm a born optimist."

Jens Lubbadeh,
journalist for *Der Spiegel Online,*
Germany, correspondent
for the *UNESCO Courier*

Biofuels

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Ethanol and biodiesel are the two kinds of biofuel.

The production of bioethanol tripled between 2000 and 2007 and was estimated at 77 billion litres in 2008. Brazil and the US are the main producers accounting for 77% of global supply.

Biodiesel derived from oil increased by a factor of 11 between 2000 and 2007 with 67% produced in the European Union (OECD-FAO, 2008).

Global ethanol production is projected to reach 127 billion litres in 2017.

In 2007, 23% of maize production in the US was used to produce ethanol, as was about 54% of Brazil's sugar cane crop. In the EU, about 47% of vegetable oil produced was used for the production of biodiesel.

The 2008 ethanol share of the gasoline transport fuel market in these countries is estimated at 4.5% for the US, 40% for Brazil and 2.2% for the EU.

About one fifth of the maize harvest in the US was used for ethanol production in 2006/2007, it only displaced about 3% of the country's gasoline (World Bank's 2008 World Development Report).

BLUE SCORPIONS AGAINST WATER CORRUPTION

(c)Félix Hénon

Dam in Swaziland.

Zero tolerance is the motto of the 'Blue Scorpions', a special unit created within the South African Department of Water Affairs and Forestry (DWAF) to fight water-related crimes. With severe water shortages, South Africa is susceptible to water corruption, but is tackling it more effectively than most of its neighbours.

As demand for clean water grows worldwide, so do concerns about corruption in the water sector. Not least in South Africa, where a government unit that combats water crime is getting a much-needed boost.

Water corruption in Southern Africa hit the headlines earlier this decade when the chief executive of a US$8 billion construction project was found guilty of having accepted more than US$2 million in bribes from multinational construction companies to secure contracts.

Masupha Ephraim Sole was in charge of the Lesotho Highlands Water Project, an ambitious programme to build dams and canals for water transfer from the highlands of Lesotho, a country the size of Belgium which is entirely surrounded by South Africa, to the dry Gauteng area around Johannesburg.

Despite limited assistance from the international community, Lesotho succeeded in bringing the erring parties to justice – the chief executive was sentenced to 18 years in prison in 2002 and some of the companies involved received multi-million fines and have been debarred from receiving World Bank contracts.

Fighting corruption

Since the incident, the governments of both Lesotho and South Africa have stepped up their fight against corruption in the water sector. Such corruption can take many forms, from petty bribing to avoid a pollution fine to multi-million payoffs to secure large contracts.

In South Africa, compliance with water regulations is monitored and enforced by a special unit in the Department of Water Affairs and Forestry (DWAF). The unit is nicknamed the "Blue Scorpions" after the country's elite anti-corruption force, the Scorpions.

The Blue Scorpions, set up in 2005, fight a range of water-related crime, from pollution to unlawful abstraction of South Africa's water courses. The funding increase will increase the unit's number of staff from a handful to, eventually, over 100. It is also going to get access to better technology, including satellite imaging, to track down wrongdoers.

Corruption is one part of the murky activity the unit unveils, says Nigel Adams, its director. "If you get to a place and there's just a big hole in the ground, but 50 million rand (nearly US$5 million) has been spent, then you know something strange has happened," he says.

His unit's success depends on three things, he says. First, its close working partnership with other government agencies and the South African police. Second, its open door policy that welcomes anyone

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concerned about their compliance with water regulations to come in and talk to the unit. The third, however, is a zero-tolerance policy for those who refuse to comply with the law. "To those people, I am hard as steel," Adams says.

Adams and his team are likely to have their work cut out for them. Last year, South Africa dropped in the corruption index compiled by Transparency International to 54th place, down from 43rd place in 2007. There is corruption on many levels in South Africa's water sector, said a representative of a water NGO who refused to be named. Some of the most common forms of dodgy dealings are fast-tracking procurement contracts and giving consultancy jobs to pals, she said.

South Africa has many 'risk factors' that make it susceptible to water corruption. It is a dry country, with some regions facing critical water shortages. Urbanisation and industrial growth are putting pressure on the water supply. In addition, the country's Institution for Civil Engineering 2006 infrastructure report card identified the need for extensive refurbishment of the country's dams and sewage systems, meaning more tenders, which can be corruption-prone.

Still, South Africa is tackling corruption more successfully than most of its poorer neighbours on the continent. The poor governance structure and large funding flows that characterise the water sector in the rest of Africa provide fertile growing grounds for abuse, according to the 2008 Global Corruption Report. The report estimates that due to corruption, the cost for reaching the Millennium Goal on drinking water and sanitation in developing countries could increase by as much as with US$48 billion over the next decade.

Such money-loss will have a direct effect on all Africans. Consumers will pay more and water quality will deteriorate (when pollution is overlooked in exchange for a bribe, for example). Meanwhile, restricted access, lower economic growth (because companies need water) and water shortages could spark unrest, damaging national security.

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"If you get to a place and there's just a big hole in the ground, but 50 million rand (nearly US $5 million) has been spent, then you know something strange has happened," says Nigel Adams, director of the Blue Scorpions.

A range of actions

But few studies investigate the situation on the ground, says Piers Cross, a consultant who is investigating water corruption in drought-stricken Ethiopia for the World Bank. Ethiopia is currently investing heavily in water infrastructure, such as dams and bringing water to rural areas.

With a large number of contracts being offered to improve access to clean water across Ethiopia, there are question-marks both over how contracts are being handled, both for large infrastructure projects and smaller-scale borehole drilling, says Cross. He's going to Ethiopia in April to take photos of new equipment. "We'll try to compare if what is built equals what is being paid for," he says.

Some countries are addressing the problem. In Zambia, following the re-organisation of the water sector to allow more local control, community-based Water Watch Groups were set up to monitor water providers' performance. The onus is on communities learning about their rights and raising awareness of infringements. A 2008 study by S. Kayaga and R. Franceys, two UK academics, found that NWASCO, the Zambian regulator, had made "commendable progress" towards better accountability and transparency in the water sector.

Due to the relatively short time water corruption has been in the spotlight, there is little information on what interventions work, says John Butterworth from the International Water and Sanitation Centre. "What has been shown is that a quick fix just pushes the corruption into a different area. If you sort out a particular aspect of your procurement, the people who were engaged in corrupt practices will just shift to another part of the process. It needs a whole range of actions."

Something that seems to work is to raise the awareness of communities of the problem and how it affects them, he adds. "It's called social accountability. Involving communities in looking at the quality of construction, making sure all material is delivered, that sort of thing."

Nor is the problem unique to Africa. Water corruption by cartels in South Asia inflated prices between 15 and 20% between 2001 and 2002, according to a survey. Recent member countries of the EU, such as Romania and Bulgaria, are, for example, ranking lower on Transparency International's corruption perception index as compared to some African or Asian countries, says Håkan Tropp, chairman of the Water Integrity Network, set up in 2006 to improve transparency and governance in the global water sector. "So it is also problem we in developed countries have to deal with in our own back yard."

Linda Nordling,
Swedish journalist
living in South Africa

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The Yangtze, near Yushu.

THE YANGTZE OR A JOURNEY THROUGH TIME

On the banks of Asia's longest river, the Yangtze, which winds some 6000 km across China, yaks and yurts cohabit with cars and high-rise buildings. Source of life to six million Chinese, it is undoubtedly also a source of development - as long as the means are there to make use of it.

Loïc and Geoffroy de La Tullaye's documentary film, 'Yangtze Expedition. An adventure by the La Tullaye brothers', shows just how crucial access to water is for human life. Here, they answer questions put by Katerina Markelova (UNESCO Courier).

Why did you choose development as the theme of your 'Yangtze Expedition'?

Geoffroy: Travelling down the Yangtze is like travelling through time. High up on the Tibetan plateau, there are still people who have to walk for three hours a day to fetch water. It's like the Stone Age. If you travel downstream for a while, it's the industrial era, with big cities that are beginning to control the water. And, in Shanghai, at the mouth of the same river, there is round-the-clock running water. It's the modern world.

We wanted our documentary to show the link between access to water and level of development. We very quickly realised that China was the ideal place for this, because of the extraordinary diversity in the ways water figures in the lives of its people.

Loïc: Through this expedition we were able to rediscover our own history. It was important to trace the evolution that western countries have gone through so that we can drink from a tap today.

The idea behind the journey was also to translate the relationships between man and water into images. In the West we have lost sight of the importance of this vital resource. It's there in abundance; even hot water comes out of a tap. And, worse still, we use drinking water to flush our toilets. Most people on the planet find this incomprehensible. In China, for example, water is so precious they see the Yangtze as a source of nourishment, like a mother.

So there is a direct link between water and development?

G: Absolutely. Because of their geographical isolation, people living high up on the Tibetan plateau are, in a way, condemned to underdevelopment. Of course, the new railway that opened in 2006 will help Tibet become less cut off, but, for the time being, there is nothing modern about life there. One Tibetan student who went back to her home village, Qmar He, in the holidays, told us she spent most of her free time fetching water. In the city, she uses this time for reading and leisure.

A little further down river, we saw a water mill, which is already a sign of development. But it took a long time before this kind of technology, albeit simple, was available. Another 1000 km further down river, we came across the famous Three Gorges dam. It is also a water mill, but much bigger. It was completed in 2009 and is the end result of a gigantic construction project that lasted 15 years. Still further down, we came across a paradox that is characteristic of all developed societies: we want clean water to drink yet still want to be able to use it to dump all of our rubbish! We finally arrived in Shanghai, where we found ourselves in a society, which, long ago, realised that, if you want to

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have drinking water, you have to treat your wastewater.

As we travelled down the Yangtze, we witnessed a whole series of stages in human development, marked by access to water, mastering it, making it secure, and managing it over the long term.

You were able to see the world's largest dam, the Three Gorges. It made navigation on the river possible, and therefore brought development. But it is also causing some serious environmental problems.

G: This dam has really turned the Yangtze into a growth highway, linking the developed East with the underdeveloped West. Since the river has been navigable, the port city of Chongqing, which is upstream of the dam, has been mushrooming: a thousand people settle there each day! It now has a population of over 32 million.

L: Having said that, most of its wastewater still goes directly into the Yangtze. This polluted water then reaches the dam, where it stagnates, loses all of its oxygen and undergoes eutrophisation. In some places on the river, the layer of algae is 30 cm thick.

If the Yangtze dies, so will the 600 million people who live in the river basin - 10% of the planet's population. If the Chinese do not act quickly, they will turn the Three Gorges reservoir into an enormous cesspit, an open-air sewage dump. And everyone knows this. If nothing is done, the treatment that the Chinese will have to apply to make the Yangtze water drinkable will be a lot more complicated than it is today, and may even be impossible. In China, surface water is still the main source of drinking water, not underground water, which is practically untapped.

What about the Yangtze river's biodiversity?

G: In 2006 pollution, the dam, increased river traffic, and extensive fishing led to the extinction of the Yangtze dolphin. The disappearance of this symbolic species caused quite a reaction, but there are still a great many other threatened species that we don't hear about. Like the Yangtze finless porpoise, which is also endemic to the river.

The extinction of the dolphin is an alarm signal. Even if we talk about the overpopulation of the planet, we might wonder if the next mammal to become extinct won't be man. Every year nearly three million people in developing countries die of water-related illnesses. Every 17 seconds a child dies of diarrhoea. So we might say the process has already started …

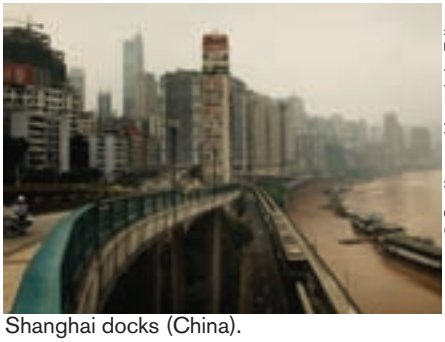
Having said this, the aim of our expeditions was not to criticise, but to provide tools so that people can interpret their environment a little better, and do something to preserve it.

© Geoffroy and Loïc de La Tullaye

Daily life in Miao Ajigen village.

© Geoffroy and Loïc de La Tullaye

Shanghai-bound boats waiting for lock entry, Three Gorges dam.



© Geoffroy and Loïc de La Tullaye

Shanghai docks (China).

Benefits from investing in water

It is estimated that for every US$ 1 invested in improved water supply and sanitation there will be gains of from US$ 3-34.

The overall economic loss in Africa alone due to lack of access to safe water and basic sanitation is estimated to be some US$ 28.4 billion per year or around 5% of GDP (WHO, 2006).

A study in the MENA region noted that groundwater resource depletion appears to have reduced the GDP of certain nations (Jordan by 2.1%, Yemen 1.5%, Egypt 1.3% and Tunisia 1.2%)

In China, there is local evidence that action on water management has delivered measurable improvements in local GDP terms. The 335 counties in China with completed primary electrification from hydropower showed a doubling of GDP compared with those without rural electricity.

Annual average income per farmer increased by 8.1% per year, nearly 3% above the national average.

Returning an over-allocated system to sustainability while combating the harmful effects of climate change and drought – these are the challenges taken on by the new Murray-Darling Basin Authority, founded in 2008. In seven years the annual inflow of one of Australia's largest river basins has dropped nearly 80%..

AUSTRALIA'S WATER REVOLUTION

© Eco Images

Clayton Sailing Club Jetty, high and dry (Clayton, Lake Alexandrina, South Australia - Lower Lakes of Murray-Darling River)

Australia's newly-created Murray-Darling Basin Authority is about to embark on a world-first venture. Chief Executive, Rob Freeman, is charged with putting together a plan covering the basin, which is the size of France. "It has never been done in the world at this scale," he said. "No-one has tried to return a system that is over-allocated [back to sustainability]."

Mr Freeman said the over-allocation is "a legacy of the past, compounded by the early onset of climate change and on top of that we have one of the worst droughts on record".

The legacy is the issuing of water licences for over 5000 gigalitres (billion litres) a year, in wetter times. The Murray River historically had an annual inflow of 8900 GL a year.

But drought struck seven years ago; in the last three years the annual inflow has averaged just 1783 GL.

The basin is highly vulnerable to climate change, because just four percent of the rain that falls on the basin ends up in the river (compared with 39% in Europe and 52% in North America). If the temperature rises one degree – and this has been happening under climate change – 15% less water flows into the river.

Before the drought struck, the Murray-Darling Basin supported 40% of the country's farm produce, including most of its irrigated agriculture, worth $A15 billion.

Its waters support over two million people, including Australia's fifth biggest city, Adelaide, but in the last three years they have endured severe water restrictions. In Adelaide, for example, gardens can only be watered with hand-held hoses for a maximum of three hours a week.

Irrigation allocations have been slashed. Along the river, grape vines and citrus trees have been bulldozed. Wetlands are drying out, and huge old river red gums are dying.

At the end of the river lie the lower lakes, separated from the ocean by man-made barrages. Those lakes are facing ecological catastrophe, according to South Australia's Commissioner for Water Security, Robyn McLeod. As the lakes dry, their acid sulphate soils become dangerously acidic when they are exposed to air. There is not enough fresh water in the Murray-Darling to keep the lake beds covered. Letting in salt water might halt the acidity, but, Ms McLeod said "they will become hypersaline very quickly and it will be a dead sea."

Measures called for

Adelaide takes up to 90% of its drinking water from the Murray, but it is developing other sources. It recycles 30% of its water, and is aiming for 45% by 2010. New housing estates have two sources of water; purified water is used in the kitchen for drinking, while recycled water, delivered through distinctive purple pipes, is used for toilet flushing, washing clothes and watering gardens.

Adelaide is also building a desalination plant that will provide one quarter of its needs by 2011.

Arguments over the water of the Murray River, which is shared by New South Wales, Victoria and South Australia, nearly halted Federation, which occurred in 1901. The States retained control over water, and the arguments about the use of the water of the

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© Liam Jon

Demonstrators outside South Australian parliament protesting bad water management.

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Murray-Darling Basin continued.

In 1991 it was clear the rivers were stressed when a one thousand kilometre long, stinking, lurid blue-green algal bloom infested the Darling River.

In 1994 the Council of Australian Governments, comprising ministers from the State Governments and the Federal Government, agreed on a new water policy. The health of the river had to be factored into all water decisions; water subsidies had to end and water licences had to be separated from land so they could be freely traded in a new water market.

Mike Young is Executive Director of the Environment Institute at the University of Adelaide. He argues that policy made Australia a world leader. "I am now spending quite a bit of time around the world advising people on how to get to a system which has the best of the Australian bits and pieces in it."

Central to the Australian system are clearly defined, tradeable shares in the available water supply. Professor Young said this "took us down a pathway looking at competition as a way to solve problems and to facilitate and expedite change. That has been a very powerful driver of reform that they haven't had in other parts of the world."

As the value of water has risen, farmers have moved from wasteful open channels and huge overhead sprays to computer-controlled drip irrigation. Water has been traded from low value-uses like flooding paddocks for cattle feed, to high-value fruit, grape and vegetable growing.

Australia on the cutting edge

But in 2006, as the severe drought gripped the Murray Darling, it was clear more changes were needed. In 2007 the Federal Government offered a radical plan: if the states would sign over responsibility for the water in the Basin to the Federal Government, it would spend $A10 billion buying back over-allocated water licences and upgrading irrigation infrastructure. It took 15 months before the states agreed.

In December 2008, a new era in Australian water management began with the establishment of the Murray-Darling Basin Authority.

Before, states were powerless to do anything about other states that breached the limits set for water extraction. South Australia, for instance, suffered fluctuations in its water supply because New South Wales was taking more than its share upstream and limiting the amount of water flowing downstream to South Australia.

The new Authority will have the power of enforcement, notably to issue injunctions to stop overdrawing of water. It will need it, because irrigation allocations are certain to be reduced.

Mr Freeman said the "new sustainable diversion limits will be based on how much water we need to retain to preserve key environmental assets and key ecosystem functions. The limits will be based on how much water we need scientifically, not how much we traditionally extracted."

It will be a huge revolution in water use, and the world will be watching how Australia does it.

Åsa Wahlquist,
Australian journalist

©UNESCO/Mario Borg

Hose for sullage waste water, Melbourne, Victoria, Australia.

WATER IN A CHANGING WORLD

We are not experiencing a global water crisis, says Olcay Ünver, coordinator of the *World Water Assessment Programme* (WWAP). But while water crises remain local, climate change is global, and we have to find global solutions for a problem that threatens the future of the planet.

© DR

Olcay Ünver, coordinator of the World Water Assessment Programme (WWAP).

Olcay Ünver talks about the latest United Nations World Water Development Report, *a comprehensive assessment of the planet's freshwater resources, which was launched last month in Istanbul (Turkey).*

Excerpts from an interview by Cathy Nolan (UNESCO)

What's new since the last report, published three years ago? Is it possible to outline the latest developments?

What has happened over the last three years in terms of the more major problems is that we have recorded considerable progress in some areas and met frustration in others. Safe drinking water, for instance – as a result of the ambitious campaign championed by the UN and agreed to by the international community, the Millennium Development Goals target seems likely to be met. Unfortunately Sub-Saharan Africa is a huge regional exception, which will need specific attention. Some Arab countries are also having difficulty.

Sanitation goals on the other hand are not very likely to be met if current trends continue. We are obviously urging the international community to provide more resources for sanitation […]

When economies develop and buying power increases, people tend to consume more water. The report gives examples to show that actually it is not the water we drink, it's the water we eat. The concept is called virtual water or water footprints – the amount of water embedded in food or other commodities needed in production. This becomes important vis-à-vis economic growth, when in emerging economies, people start eating more meat rather than, say, grains or rice, or start eating three instead of two meals; it means a lot more water to produce the food. Also to manufacture the cars they want to

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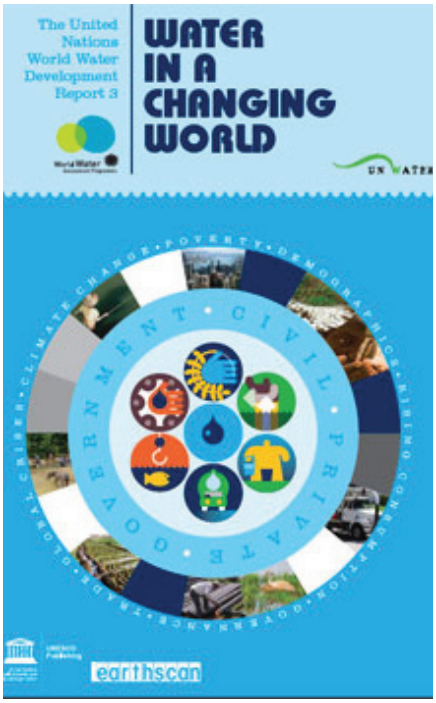

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Cover of latest *United Nations World Water Development Report*

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drive and other consumer products demanded. On top of this you have to add the pollution that comes from a lot of these activities. That is another driver. It influences water resources. […]

Another message of the report is that water problems are created and potentially solved by decision makers that are not the actual water managers. When I talk about leaders, I am talking in a broader sense, not leaders in the water sector. The past two reports and the processes have provided a good consensus among water resources professionals and leadership in the water community. But now we need to get out of the water box and get the broader framework involved in the identification and solution of water problems and preventing further water crisis.

The report encourages more investment in water?

The report has a complete section on the investment aspect. Obviously the current crisis will have impact on water. What we are saying is that water infrastructure is not to be neglected and that investment in water infrastructure is to be accelerated.

We are saying that, in order to deal with the current crisis, water infrastructure and governance are more important than ever. Investing in water provides benefits not only to the society but to the economy.

Does the report make recommendations for averting a water crisis?

This is not a prescriptive report. There are water crises around the world, but hydrology is local, meteorology is global. We have now water crises around the world but we are not talking about a global water crisis. We are warning against one if the existing crises are not addressed properly and if water is not made an integral component of broader decision making frameworks. An excellent example is the food sector. You may want to increase production, but if you don't have the resources – irrigation water – you have a constraint. You cannot only resolve the food crisis - you create pressure on water resources that could turn into crisis.

With increasing water scarcity, water becomes increasingly a political issue. Does the report address this aspect?

It's a fact, when you have abundant resources, everybody is happy. When demand increases or the resource decreases, then you start seeing competition, then you start managing the demand in many ways. It can be economic, social, legal or a combination. As the situation worsens, you may have to reallocate water from some sectors to others, and competition can turn into conflict. Managing the competition is very important so that conflict will not arise. There are plenty of examples of the report on how nations or river basins or municipalities have dealt with these issues. There are statistics and examples of conflicts as well. Again, there are general recommendations. The report avoids sweeping generalizations and indicates at the beginning that, like water problems, solutions depend on circumstances in the country or society – resource endowment, financial resources, culture, legal framework. Each country should look for their own solutions, using what can be learned from others who have successfully dealt with them.

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With the current crisis, "water infrastructures and governance are more important than ever." Malagasy woman drawing water from a fountain.

Saving our nearest relatives

Humanity's closest relative, the gorilla, is in danger. Development, poaching and war have been decimating one of the only animal species which, like us, can use tools. Nevertheless, UNESCO's gorilla preservation projects have begun to bear fruit in this International Year of the Gorilla, 2009. The main objective of the International Year of the Gorilla is to mobilize decision-makers and the public to save this great ape species, a species capable of intelligent thinking, 95% of whose DNA is identical to ours. This is of vital importance as populations have been declining in recent decades.

© UNESCO/Ian Redmond

Young mountain gorilla (Rwanda).

Every animal species is valuable and has a part to play in maintaining the ecological balance of its natural habitat, but the cause of the gorilla elicits particular sympathy because they are so similar to us. So much so that their name, has its root the Greek word *gorillai*, meaning tribe of hairy women, used by the Carthaginian, Hanno the Navigator, who sailed along the coast of West Africa in the 5th century B.C. and spotted hirsute creatures, some kind of ape if not actual gorillas, on his voyage

In the absence of visual evidence from Hanno's journey, it is impossible to tell whether gorillas are indeed the "hairy women" he named. Up to date complete data about the gorillas is still not always available, but modern science divides them into two species - Eastern and Western gorillas - and four subspecies (see box).

Social organization

Each subspecies has feeding, physiological and life style differences. But all gorillas are migratory and live in groups of five to 30 individuals dominated by one silverback adult male, typically 12 years of age or older. The silverback is the strong, dominant leader who is the centre of attention, makes all decisions, mediates conflicts, determines the movements of the group, leads the others to feeding sites and takes responsibility for the safety and well-being of all.

Younger males, called blackbacks, may serve as backup protection. Males will slowly begin to leave their original troop when they are about 11 years old, travelling alone or with a group of other males for 2–5 years before they attract females to form a new group and start breeding. Gorillas are vegetarian but silverbacks have been known to kill the young child of their predecessor. They will then mate with the female whose child they killed.

Gorillas only breed every three or four years. Because of their migratory lifestyle, they require a lot

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Four Subspecies of Gorillas

Modern science divides gorillas into two species - Eastern and Western gorillas - and four subspecies: Western lowland gorillas, Cross River gorillas, Mountain gorillas and Eastern lowland gorillas.

© UNESCO/Ian Redmond

Young lowland gorilla hitching a ride (Congo).

The **Western Lowland Gorilla** *(Gorilla gorilla gorilla)* is estimated to have declined by more than 60% over the last two decades due to death from hunting and disease, notably Ebola. Population was estimated at 100,000 in the 1980s, but populations which had not been counted before were discovered in remote swamp forests in the northern part of the Democratic Republic of Congo bringing total estimates up to 150,000 - 200,000 mainly in Cameroon, the Central African Republic, Gabon, Congo, and Equatorial Guinea. The subspecies is the smallest and lightest of the four subspecies.

The **Cross River Gorilla** *(Gorilla gorilla diehli)* is a recently recognized subspecies of Western Gorilla living in tropical and subtropical broadleaf forests at elevations of 200 to 2000 metres on the northern Cameroon-Nigerian border in an area of less than 10,000 km². They are found in eleven localities most of them connected by continuous forest. The subspecies, totalling a mere 300 individuals, is critically endangered. It is particularly shy of humans and only few direct sightings have been made. Most information on their ecology and behaviour derives from observations of sleeping nests, feeding trails and reports by local hunters. The main morphological difference between the Cross River Gorilla and the Western Lowland Gorilla concerns the shape of their heads.

The high forest **Mountain Gorilla** *(Gorilla beringei beringei)* is believed to total only 650 to 680 individuals, living in two isolated groups within protected areas in the Virunga Massif along the borders of the DRC, Rwanda, and Uganda, in the Virunga National Park (DRC), the Volcanoes National Park (Rwanda) and the Mgahinga Gorilla National Park (Uganda). A separate population of Mountain Gorillas is found in the Bwindi Impenetrable National Park in southwest Uganda. A 2003 census of the Virunga Volcanoes Mountain Gorilla population showed a 17% increase since 1989. But the subspecies remains critically endangered due to habitat loss, poaching, human disease and war. It is very black and densely furred, with a broad face and massive jaws. The small of the back of mature males turns grey with age, hence the name of 'silverback' for mature males.

Eastern Lowland Gorillas *(Gorilla beringei graueri)* have been severely affected by instability and war in much of its natural habitat since the 1990s. An increase in hunting of Eastern Lowland gorillas has been observed in war-torn eastern DRC, and their habitat is under stress due to mining for coltan ore, agriculture and charcoal production. Anecdotal evidence suggests a significant decline over the past 20-30 years. In the mid-1990s, population was estimated at 17,000. The Eastern Gorilla tends to be larger than the Western, with longer, blacker hair.

R. A.

Saving our nearest relatives

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of space, which is why UNESCO favours the definition of large landscapes for their preservation, areas that include a wide buffer zone with biosphere reserves where people can find sustainable livelihoods. Education projects to help the inhabitants understand, respect and maximize the benefits of sustainable resource management are essential for the success of these preservation projects.

All species are important

Mambaele Mankoto of UNESCO's Natural Science Sector is heartened by the recent increase observed in gorilla populations in the Virunga National Park, a UNESCO World Heritage site. This improvement can be attributed to ambitious programmes for conservation of biodiversity in regions of armed conflict launched by UNESCO in 2000 with the United Nations Foundation and the European Union. The projects have focused heavily on helping forest guards carry out their all-important work. "But conflicts are still latent and we must not lower our guard," cautions Mankoto, who highlights the need to convince donors to provide funds for projects that specifically target gorilla preservation.

One way to reduce hunting for bushmeat and traditional medicine is to convince local populations that gorillas are worth more alive than dead. Conservation institutions in the RDC and the Rwandan National Parks Office have concluded an accord whereby gorillas that come from RDC to Rwanda are visited by tourists there and Rwanda pays a share of the profit, US$ 30,000 per annum on average, back to the RDC. Mankoto welcomes this as a fine example of transboundary cooperation within UNESCO's mandate of peace-building with the gorillas as ambassadors.

Nevertheless, gorilla tourism must be managed with care, as contact with humans can have a negative impact on these great apes whose immune systems are unprepared for some of the diseases we carry. Humans also continue killing gorillas not just for bushmeat but also for cultural reasons. While some people still believe that placing a gorilla bone in a baby's bathwater will fortify the child, the major threats facing our closest animal cousins remain deforestation, road-building, traps laid for other animals and mining.

Mankoto for his part hopes that the International Year of the Gorilla - launched by the United Nations Environment Programme's Convention on Migratory Species (CMS), the UNEP/UNESCO Great Apes Survival Partnership (GRASP) and the World Association of Zoos and Aquariums (WAZA) - will serve as a plea for this animal which, in captivity, has proven it can acquire an impressive mastery of human sign language.

In their natural habitat, gorillas provide valuable services in forest husbandry as they make clearings along their migratory path, allowing the sun to reach the underbrush, and digest seeds of species which they disseminate in their faeces. Mankoto reminds us of the need to resist anthropocentrism: "All species are important; the loss of any species represents an impoverishment of the environment – physical, cultural and spiritual."

Roni Amelan
(UNESCO)

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Old Titus with a group of mountain gorillas (Congo).

© UNESCO/Ian Redmond

Martyn Colbech filming gorillas in Rwanda.

PROTECTING GORILLAS BEGINS WITH EDUCATION

Like elephants, gorillas are migratory species that need wide areas. Conserving such species is not about fencing large areas but about teaching populations to contribute to conservation through good territorial management policies. This requires educating the young and UNESCO has not waited for the International Year of the Gorilla to start this work.

© UNESCO

Family of gorillas in Uganda.

The main axes for UNESCO's activities in favour of the gorilla are its *World Heritage Centre* and the *Man and the Biosphere* (MAB) Programme. But education projects have also contributed to these programmes, particularly now, during the Decade for Education for Sustainable Development.

UNESCO recently granted US $100,000 for GRASP scholarships for young researchers who spent two years studying issues pertaining to great apes.

The *Regional School on Integrated Management of Tropical Forests and Territories* (ERAIFT) [Ecole Regionale post-universitaire d' Amenagements et gestions Intégrés des Forets et Territories tropicaux] was created by UNESCO ten years ago at Kinshasa University with support from the RDC, the United Nations Development Programme, the European Union which has just announced a four million-Euro allocation within the framework of the 10th European Development Fund (2009-2013), Belgium, France and several partners such as the *World Wide Fund for Nature* (WWF). The school brings together young postgraduates specializing in human and social sciences with geographers, sociologists and economists along with agronomists, forest managers, biologists, and ecologists.

They follow an 18-month Masters programme which includes six months of fieldwork. This allows for cross-disciplinary training, favouring a multidisciplinary grasp of issues which can help open the students' eyes to new approaches.

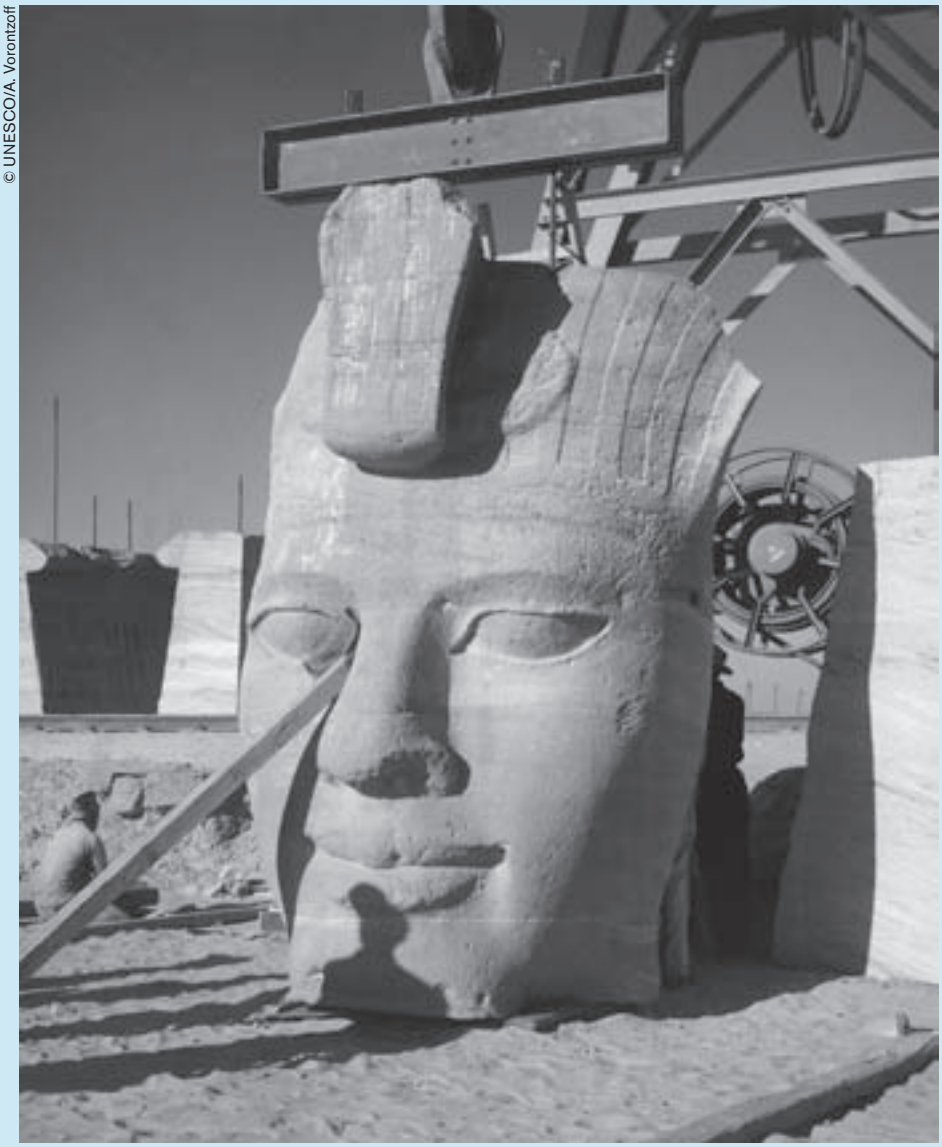
Eighty-one masters from 12 African countries have been trained to date along with three PhDs.

A further 60 people will hopefully be trained by 2013.

R. A.

Monuments of Nubia, past and future

In 1959, the governments of Egypt and Sudan asked UNESCO for assistance in safeguarding monuments that the construction of the Aswan High Dam threatened to submerge. This inspired a major campaign by UNESCO to safeguard cultural heritage. The success of the Campaign inspired the development and adoption in 1972 of UNESCO's World Heritage Convention and the inscription of sites on UNESCO's World Heritage List on which the Nubian Monuments from Abu Simbel to Philae were inscribed in 1979. To mark the 50th anniversary of the appeal to save the monuments of Nubia, UNESCO's office in Cairo organized a conference in cooperation with the Egyptian and Sudanese ministries of culture.



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Safeguarding Nubian monuments: detached head of Great Temple colossus in storage.

Confronting Climate Change in the Arctic

The rapidly changing climate in the Arctic is putting pressure on hundreds of thousands of indigenous people in the circumpolar North.
In March 2009, UNESCO organized a conference in Monaco to address the concerns of the Arctic community and identify strategies for the sustainable development of the region.

Education for Sustainable Development

The UNESCO World Conference on Education for Sustainable Development (ESD) will be held from 31 March to 2 April in Bonn (Germany). The event brings together some 700 experts and stakeholders. Graça Machel, international advocate for women's and children's rights and former Minister of Education and Culture in Mozambique, will present a keynote speech.
The conference will underline the relevance of ESD to all of education; promote international exchange on ESD, especially between North and South; assess results of the United Nations ESD Decade (2005-2014); and develop strategies for the future.

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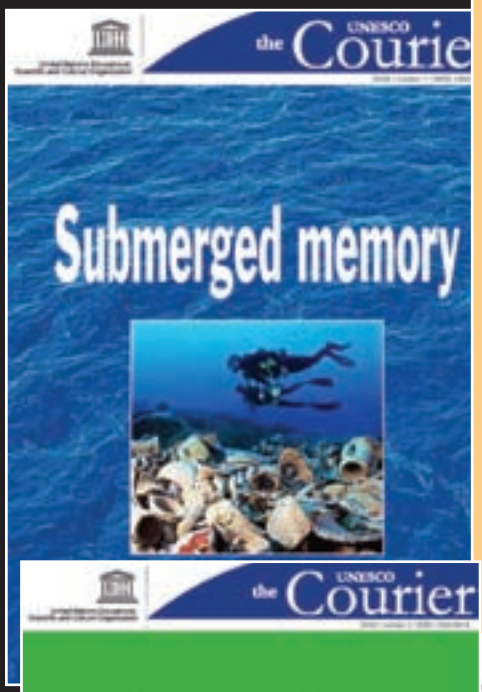
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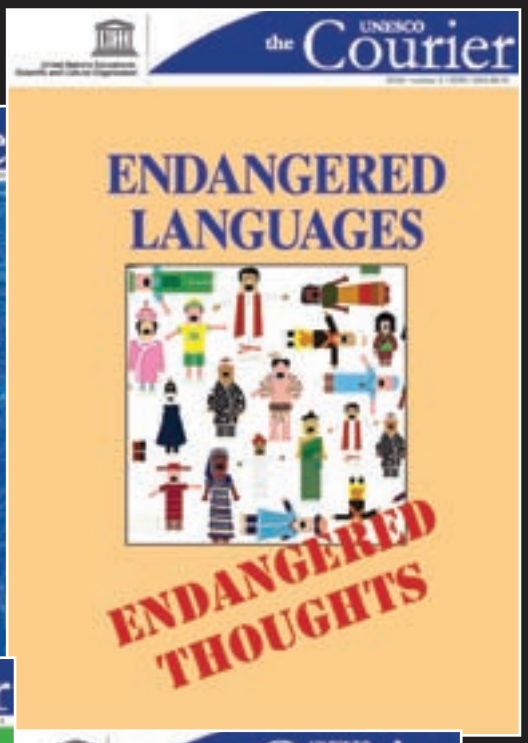
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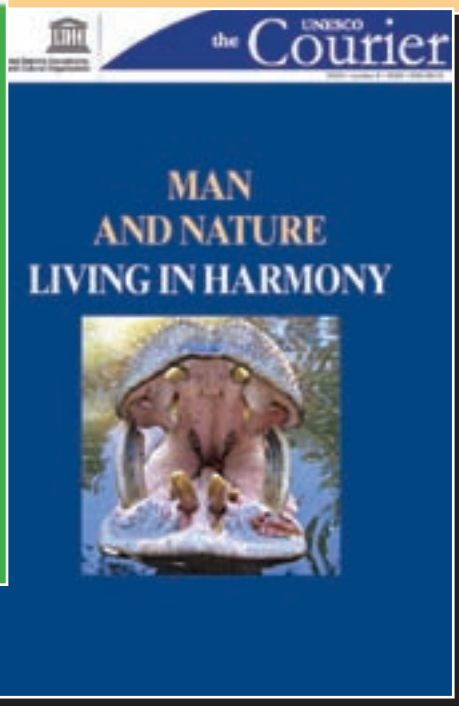
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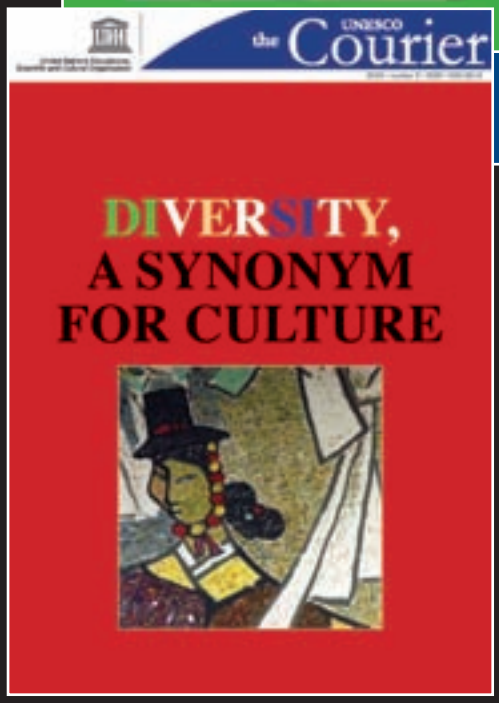
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